

This Supernova Just Won't Fade Away (Forwarded)

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Scientists say that a star which exploded in 1979 still shines as brightly in X-rays today as it did when X-ray telescopes first observed it years ago. This is a surprise finding because such objects usually fade significantly after only a few months.

The scientists could document a unique history of the star, both before and after the explosion, by studying rings of light leftover from the blast, similar to the way climate history is derived from analyzing rings in a tree trunk. Dr. Stefan Immler at NASA's Goddard Space Flight Center in Greenbelt, Md., led this observation using the European Space Agency's XMM-Newton observatory. The star explosion (supernova), called SN 1979C, shows no sign of letting up, he said.

"This 25-year-old candle in the night has allowed us to study aspects of a star explosion never before seen in such detail," Immler said. "All the important information that usually fades away in a couple of months is still there."

Among the many unique finds, Immler said, is the history of the star's stellar wind dating back 16,000 years before the explosion. Such a history is not even known about our Sun. Also, the scientists could measure the density of the material around the star, another first.

The lingering mystery, though, is how this star could fade away in visible light yet remain so radiant in X-rays. The results appear in *The Astrophysical Journal*.

Stars explode when they run out of fuel to burn. Stars more than 10 times the mass of our Sun will explode in an event called a core-collapse supernova. Without fuel and thus energy to support its gravity, such

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stars first implode. The core reaches a critical density, and much of the infalling matter gets bounced back out violently into space by powerful shockwaves.

Supernovae can outshine an entire galaxy and are often easily seen in neighboring galaxies with a backyard telescope. Supernovae are typically half as bright after about ten days and fade steadily after that, regardless of the wavelength. SN 1979C has in fact faded in optical light which is now just barely visible with a good amateur telescope. In X-rays, however, this supernova is still the brightest object in its host galaxy.

"We can use the X-ray light from SN 1979C as a 'time machine' to study the life of a dead star long before it exploded," Immler said.

Immler's team will attempt to identify the history of the star that created SN 1979C through a process similar to counting rings in a tree trunk. This star, about 18 times more massive than our Sun, produced fierce stellar winds. That material was flung into space for millions of years, creating concentric rings around the star and the X-rays have illuminated 16,000 years' worth of stellar activity. Immler speculates that the abundance of stellar wind has provided ample material to keep SN 1979C glowing so brightly.

"XMM-Newton is known among scientists as a superior X-ray observatory, but the study of SN 1979C demonstrates the importance of the satellite's simultaneously observing UV and optical telescope," said Dr. Norbert Schartel, XMM-Newton Project Scientist at ESA's European Space Astronomy Centre (ESAC) in Madrid.

Immler is a member of the XMM-Newton U.S. Guest Observer Facility, based at NASA Goddard, and teaches cosmology at the University of Maryland, College Park. He is funded at NASA Goddard through the Universities Space Research Association.

Related links:

- * More about supernovae
http://imagine.gsfc.nasa.gov/docs/science/know_11/supernovae.html
- * More about the XMM-Newton mission
<http://sci.esa.int/science-e/www/area/index.cfm?fareaid=23>

IMAGE CAPTIONS:

[Image 1:

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Print resolution -- no labels (450 KB):

http://www.nasa.gov/centers/goddard/images/content/115351main_M100_XMM_OM_plain.jpg

Print resolution still w/labels (450 KB):

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This optical-ultraviolet image shows a face-on view of the grand-design spiral galaxy M100, about 56 million light years away in the Virgo galaxy cluster. The galaxy is about 100,000 light years across, much like our own spiral galaxy. The position of SN 1979C is marked with a white circle. The image was taken with XMM-Newton's Optical Monitor in the B, U, and UVW1 filters. (The streak across the image is from an artifact caused by the camera.)

Credit: NASA/ESA/Immer et al.

[Image 2:

Print resolution -- no labels (450 KB):

http://www.nasa.gov/centers/goddard/images/content/115362main_M100_XMM_xray_plain.jpg

Print resolution still w/labels (450 KB):

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This is an image of X-ray light from the galaxy M100. No longer do we see the prominent spiral arms of the galaxy, apparent in optical images. Instead, the X-ray image reveals high-energy activity throughout the galaxy. The most active region is the galaxy center. The red and orange regions are sources of very hot, diffuse gas between stars. SN 1979C is the orange hotspot about "7 o'clock" from the white galactic center. (This image is a composite of three X-ray energy bands: soft, 0.3-1.5 keV (in red); medium, 1.5-4 keV (in green); and hard, 4-10 keV (in blue, which is blended into the white core).

Credit: NASA/ESA/Immler et al.

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